

## 1    CLAIMS:

2

3    1. An apparatus for spraying liquid surface treatment  
4    material, said apparatus comprising:

5        a housing;

6        a liquid inlet for supply of the liquid surface  
7    treatment material;8        a gas inlet for supply of pressurised gas to be  
9    mixed with the liquid surface treatment material;10      an outlet nozzle through which the gas and liquid  
11    surface treatment material is sprayed;12      a control valve adapted to regulate the supply of  
13    the liquid surface treatment material to the outlet  
14    nozzle;15      a gas valve operable between an open position and  
16    a closed position;17      a first communicating passageway connecting said  
18    gas inlet to said gas valve; and19      a second communicating passageway connecting said  
20    gas valve to said outlet nozzle;21      wherein said second passageway is provided with a  
22    stepped portion therein so that a gas vortex is created  
23    therethrough.

24

25    2. An apparatus according to Claim 1, wherein said  
26    second passageway is offset from said first passageway.

27

28    3. An apparatus according to either Claim 1 or Claim  
29    2, wherein said second passageway is substantially  
30    conical in shape.

31

32    4. An apparatus according to any preceding claim,  
33    wherein said second passageway includes an inlet and an  
34    outlet, wherein said second passageway is tapered from  
35    said inlet to said outlet.

36

1       5. An apparatus according to Claim 4, wherein said  
2       taper is between 1 to 15°.

3

4       6. An apparatus according to either Claim 4 or Claim  
5       5, wherein said second passageway has a radius of  
6       curvature at said outlet so as to provide gas to the  
7       outlet nozzle in a substantially horizontal direction.

8

9       7. An apparatus according to any preceding claim,  
10      wherein said stepped portion of said second passageway  
11      comprises a ledge whose width tapers up to a maximum of  
12      10% of the radius of said second passageway at the  
13      level of the stepped portion.

14

15      8. An apparatus according to Claim 7, wherein the  
16      longitudinal axis of said outlet nozzle extends across  
17      said second passageway.

18

19      9. An apparatus according to Claim 8, wherein the  
20      axis of symmetry of said ledge is offset from said  
21      longitudinal axis of said outlet nozzle.

22

23      10. An apparatus for spraying liquid surface treatment  
24      material, said apparatus comprising:

25        a housing;

26        a liquid inlet for supply of the liquid surface  
27        treatment material;

28        a gas inlet for supply of pressurised gas to be  
29        mixed with the liquid surface treatment material;

30        an outlet nozzle through which the gas and liquid  
31        surface treatment material is sprayed;

32        a control valve adapted to regulate the supply of  
33        the liquid surface treatment material to the outlet  
34        nozzle;

35        a gas valve operable between an open position and  
36        a closed position;

1           a first communicating passageway connecting said  
2    gas inlet to said gas valve; and

3           a second communicating passageway connecting said  
4    gas valve to said outlet nozzle;

5           wherein said second passageway is axially offset  
6    from said first passageway and is substantially conical  
7    in shape, and wherein said second passageway includes  
8    an inlet and an outlet and is tapered from said inlet  
9    to said outlet at an angle of taper of between 1 and  
10   15°.

11

12   11. An apparatus according to any preceding claim,  
13   further comprising a trigger means;

14           whereby said trigger means is adapted to operate  
15   both of said control valve and said gas valve.

16

17   12. An apparatus according to Claim 11, wherein said  
18   control valve is a liquid control needle valve.

19

20   13. An apparatus according to Claim 12, wherein said  
21   gas valve is an axially-sliding piston valve.

22

23   14. An apparatus according to Claim 13, wherein said  
24   outlet nozzle is controlled by said liquid control  
25   needle valve.

26

27   15. An apparatus according to either Claim 13 or Claim  
28   14, wherein said piston valve produces an annular air  
29   jet in said second passageway.

30

31   16. An apparatus according to any of Claims 13 to 15,  
32   further comprising an air control valve stem which is  
33   connected to said piston valve and operated by said  
34   trigger means.

35

36   17. An apparatus according to any of Claims 13 to 16,

1       wherein said piston valve comprises an inner apertured  
2       sleeve and an outer apertured sleeve, said inner and  
3       outer sleeves being co-axial, and wherein said inner  
4       sleeve is located within said outer sleeve and is  
5       rotatably adjustable relative to said outer sleeve.

6  
7       18. An apparatus according to any of Claims 12 to 17,  
8       wherein the liquid control needle valve is controlled  
9       by said trigger means via an axially-sliding sleeve or  
10      slipper member situated on a rearward portion of said  
11      housing.

12  
13      19. An apparatus according to any of Claims 12 to 18,  
14      wherein said liquid control needle valve is provided  
15      with a rotational flow adjustment means.

16  
17      20. An apparatus according to Claim 19, wherein said  
18      flow adjustment means comprises a stem member, a  
19      rotational adjuster, and a return spring, said stem  
20      member being threaded at its rearmost extremity to  
21      accept said rotational adjuster.

22  
23      21. An apparatus according to Claim 20, wherein said  
24      stem member is actuated externally by said trigger  
25      means, and is returned to its initial position by said  
26      return spring.

27  
28      22. An apparatus according to any of Claims 12 to 21,  
29      wherein said liquid inlet comprises a pressurized  
30      material supply connector, and wherein said needle  
31      valve is supplied with a liquid by said pressurized  
32      material supply connector.

33  
34      23. An apparatus according to any of Claims 12 to 21,  
35      wherein said liquid inlet comprises a gravity feed  
36      liquid reservoir, and wherein said needle valve is

1 supplied with a liquid by said gravity liquid  
2 reservoir.

3  
4 24. An apparatus according to any preceding claim,  
5 further comprising a regulating valve and a pair of  
6 side jets, whereby the spray pattern of the outlet  
7 nozzle is regulated by said regulating valve, and said  
8 side jets are utilised to regulate said spray pattern.

9  
10 25. A method of spraying a liquid onto a surface, said  
11 method comprising the steps of:

12 supplying a liquid to be sprayed into a liquid  
13 inlet of a spray apparatus;

14 supplying a pressurised gaseous propellant into a  
15 gas inlet of said spray apparatus;

16 passing said gaseous propellant through a  
17 communicating passageway from said gas inlet to an  
18 outlet nozzle;

19 accelerating said gaseous propellant by creating a  
20 gas vortex as said propellant passes through said  
21 communicating passageway;

22 passing said accelerated propellant through an  
23 outwardly tapering portion of the communicating  
24 passageway to further accelerate the vortex and supply  
25 the propellant to the outlet nozzle in the form of an  
26 annular gas jet; and

27 spraying said liquid onto a surface by mixing said  
28 liquid and said annular gas jet at said nozzle.

29  
30 26. A method according to Claim 25, wherein said  
31 passageway comprises an upper portion and a lower  
32 portion, wherein said upper portion is axially offset  
33 from said lower portion and is substantially conical in  
34 shape.

35  
36 27. A method according to Claim 26 wherein said upper

1 portion of said passageway includes an inlet and an  
2 outlet and is tapered from said inlet to said outlet at  
3 an angle of taper of between 1 and 15°.

4

5 28. A method according to any of Claims 25 to 27,  
6 wherein the mixing of said liquid and said annular gas  
7 jet is controlled by a trigger valve mechanism on said  
8 spray apparatus.

9

10 29. A method according to Claim 28, wherein said  
11 trigger valve mechanism comprises:

12 a gas valve operable between an open position and  
13 a closed position;

14 a control valve adapted to regulate the supply of  
15 the liquid to be sprayed; and

16 a trigger means;

17 whereby said trigger means is adapted to operate  
18 both of said gas and control valves.

19

20 30. A method according to Claim 29, wherein said  
21 control valve is a liquid control needle valve.

22

23 31. A method according to Claim 30, wherein said gas  
24 valve is an axially-sliding piston valve.

25

26 32. A method according to Claim 31, wherein said  
27 piston valve comprises an inner apertured sleeve and an  
28 outer apertured sleeve, said inner and outer sleeves  
29 being co-axial, and wherein said inner sleeve is  
30 located within said outer sleeve and is rotatably  
31 adjustable relative to said outer sleeve.

32